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NEW RECORDS OF *VAUCHERIA* (XANTHOPHYCEAE) IN MONGOLIA

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During expeditions of 2015 and 2022, four *Vaucheria* species were found in central and northwestern parts of Mongolia. *Vaucheria alaskana*, *V. nuoljae* and *V. racemosa* are new national records. Morphology of species is briefly described and illustrated.

Keywords: yellow-green algae, Arkhangai aimag, Khövsgöl aimag, Zavkhan aimag

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INTRODUCTION

Vaucheria DC. (Vaucheriaceae, Xanthophyceae) is among species-rich genera of yellow-green algae that can be delineated through coenocytic filamentous thallus and oogamous reproduction. Despite worldwide distribution, the genus remains poorly studied in many regions.

According to the most recent checklist of algae in Mongolia [Bukhchuluun, Baigal-Amar, 2018], only two species of *Vaucheria* are reported: *V. bursata* (O. Müller) C. Agardh (as *V. sessilis* (Vauch.) DC.) and *V. canalicularis* (L.) T.A. Chr., both with limited distributional records. Given the relatively slow accumulation of floristic data for a region as vast as Mongolia, I have decided to publish here some new records of *Vaucheria* obtained during expeditions in 2015 and 2022. I hope this will stimulate further research into this group in Mongolia.

MATERIAL AND METHODS

Species of *Vaucheria* were searched by the author in various aquatic and semi-terrestrial habitats across eight localities in Arkhangai, Zavkhan, and Khövsgöl aimags, situated in central and northwestern Mongolia. Most localities were discovered along the shoreline of Lake Khövsgöl, with others in the Orhon River floodplain and Lake Bayan. These localities are classified into mountain meadows and taiga (Khövsgöl), desert (Bayan), and steppe (Orhon) regions based on climatic and orographic characteristics, with altitudes ranging between 1330–1715 m. Algae were typically found near water edge or in shallow water (up to 30 cm depth).

Specimens were either air-dried on herbarium sheets or preserved in 95% ethanol. In the laboratory, pieces of filaments were gently untangled with dissecting needles, rinsed with tap water to remove mud particles, and examined under a CNOEC 2000 series microscope (Opto-Edu (Beijing) Co. Ltd.) with a 10 MP CMOS digital camera. Species identification was based on key monographic treatments of some regional *Vaucheria* floras [Blum, 1972; Rieth, 1980; Wang, 2007].

Dried vouchers were deposited at the Komarov Botanical Institute of RAS, Saint Petersburg (LE), while moist vouchers were retained at the Laboratory for Algology, Papanin Institute for Biology of Inland Waters of RAS, Borok (cited as V-n). One specimen was deposited in the Herbarium of algae at the Botanic Garden and Research Institute of MAS, Ulaanbaatar (UBA). List of the studied localities is provided below.

1) Arkhangai aimag, Ogiinuur sum, oxbow between the Orkhon and Högshin Orkhon rivers [47.7799°N, 102.6370°E], ~1330 m, near the bridge, bank trampled by cattle, *Schoenoplectus* community, in thin layer of water, water conductivity 1830 µS/cm, 5 VII 2015;

2) Khövsgöl aimag, Chandmani-Öndör sum, Lake Khövsgöl, 1642 m, E shore, Khilem Bay, [50.6442°N, 100.5210°E], on damp soil trampled by cattle along the shore, 22 VII 2015;

3) Chandmani-Öndör sum, near the Modot-Tokhoi Bay, 1645 m, small lake near the river mouth, [50.7543°N, 100.5177°E], on dried-up sediments, 22 VII 2015;

4) Chandmani-Öndör sum, tributary of Lake Khövsgöl, [50.9658°N, 100.7497°E], ~1715 m, in water between stones, water conductivity 340 µS/cm, 22 VII 2015;

5) Khankh sum, small thermokarst lake at N edge of Lake Khövsgöl, 1652 m, 51.62187°N, 100.52230°E, water conductivity 1.3 mS/cm, pH 8.77, t 26.7°C, in water, 18 VII 2022;

6) Khankh sum, Khajuu spring, 1666 m, shore of thermokarst lake trampled by cattle, 51.63218°N, 100.56086°E, on soil, 18 VII 2022;

7) Khatgal sum, lagoon lake near the bar of W shore of Lake Khövsgöl, [50.61°N, 100.21°E], 1642 m, on mossy soil trampled by cattle, 19 VII 2015;

8) Zavkhan aimag, Santmargats sum, Great Lakes Depression (Gobi Desert), Lake Bayan, 1501 m, accumulative shores of N [48.4981°N, 95.1103°E] and NE [48.4920N, 95.1568E] parts of the lake, on damp soil under therophytes, 13 VII 2015.

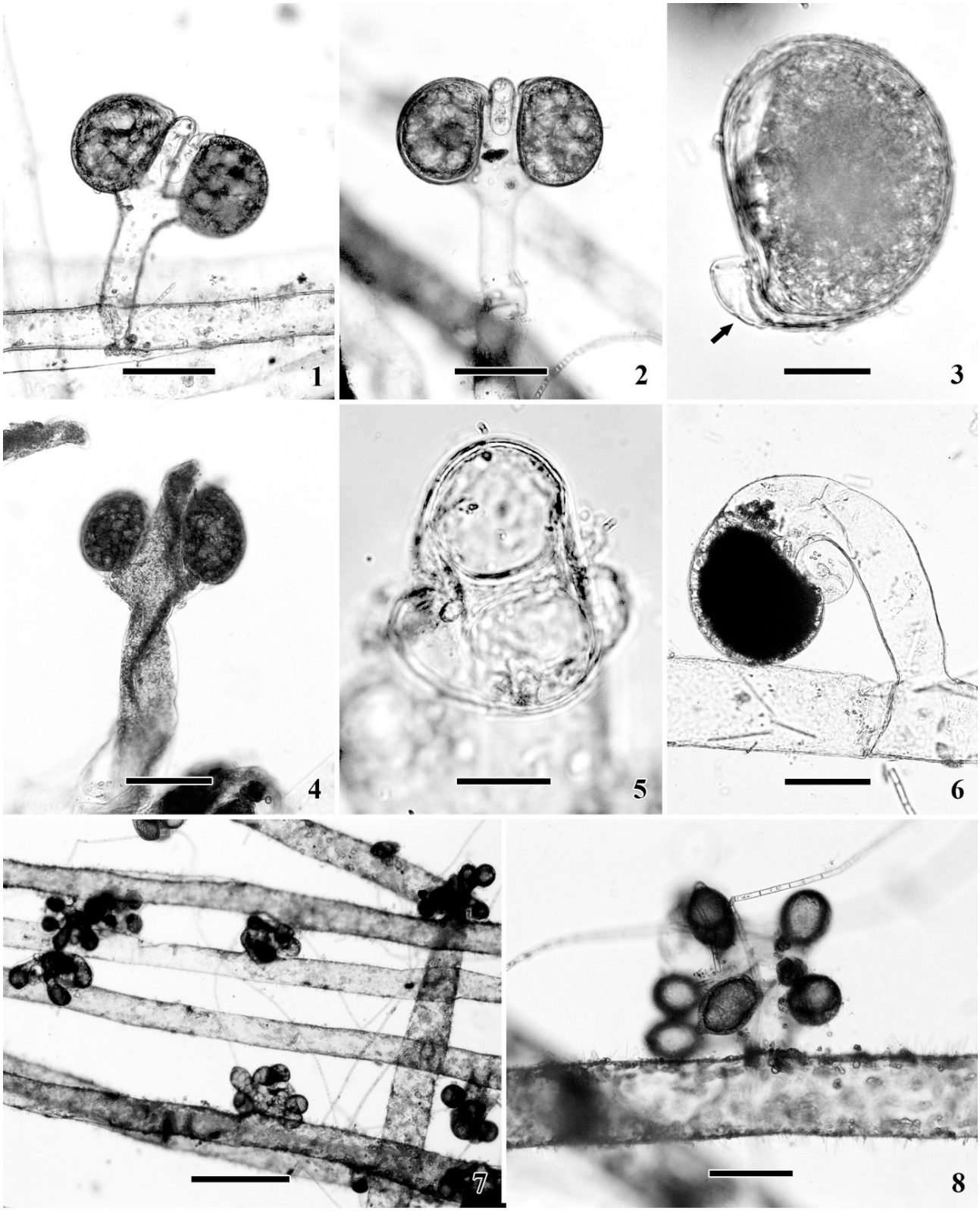

Fig. 1–8. Morphological features of *Vaucheria* species from Mongolia: 1, 2 — *V. alaskana*, fruiting branches, V-976; 3 — *V. alaskana*, fallen oogonium with oospore, terminal oogonial cavity is indicated by arrow, LE A0004238; 4 — *V. canalicularis*, fruiting branch, V-979; 5 — *V. canalicularis*, deltoid antheridium, V-978; 6 — *V. nuoljae*, fruiting branch, V-982; 7, 8 — *V. racemosa*, filaments with fruiting branches, V-976. Scales: 1, 2, 4, 6, 8 — 100 µm, 3, 5 — 40 µm, 7 — 300 µm.

RESULTS AND DISCUSSION

Four species were identified, three of which are new national records (indicated by an asterisk). Each sample contained one or two species.

V. alaskana J. Blum (Figs 1–3)

Localities and specimens: 1 — V-978, 2 — V-980, 3 — V-981, 5 — V-976, LE A0004235, A0004239, 6 — LE A0004238, 7 — LE A0004237. Filaments 43–65 μm in diam., oogonia (1)2 per fruiting branch, 100–140 μm length, 77.5–105 μm in diam.; antheridia 20–31 μm in diam.

The specimens exhibit somewhat larger oogonia and variation in oospore wall coloration and thickness compared to previously recorded populations [cf. Blum, 1953; Rieth, 1980]. Blum originally described the oospore wall of *V. alaskana* as thin, double-layered, and colorless. In the studied material, the oospore wall was sometimes yellowish-colored, its thickness could vary significantly, and the number of layers couldn't always be counted because they were uneven. Nonetheless, all of the specimens exhibit the narrow terminal oogonial cavity (Fig. 3), which is the most distinctive feature of the species.

The nearest localities are in Siberia, the Irkutsk Region, the Republic of Buryatia and the Republic of Altai [Vishnyakov, 2019, 2021; Kotkova et al., 2025], as well as in NE China, Inner Mongolia [Rieth, 1963]. The species is sporadically distributed in the Holarctic, also known from the Caucasus and Europe, with one isolated locality in the Peruvian Andes [Blum, 1972; Rieth, 1980; Vishnyakov et al., 2020]. The records in India are questionable, as identifications were either based on material with immature gametangia [Santra, Adhya, 1976] or material with smaller gametangia that resembles *V. pseudogeminata* Dang. [Sarma, Rattan, 1990].

V. canalicularis (L.) T.A. Chr. (Figs 4, 5)

Localities and specimens: 1 — V-978, UBA 5444, 2 — V-980, 8 — V-979, LE A0004240. Filaments 30–60 μm in diam., oogonia (1)2 on fruiting branch, 76.25–112.5 μm length, 57.5–78.75 μm in diam.; antheridia 33.75–40 μm in diam. The most distinctive feature of this species is a deltoid antheridium with pores on lateral papillae (Fig. 5).

In Mongolia, the species was previously recorded in the Arkhangai aimag: the benthos of the Högshin Orhon River [Bukhchuluun, Baigal-Amar, 2018]. This record is actually based on material collected from the oxbow in floodplain area between the Orhon and Högshin Orhon rivers (locality no. 1). The species has cosmopolitan distribution, with the nearest known localities in Baikal Siberia [Vishnyakov, 2019, 2021], Altai [Kotkova et al., 2025], and NE China [Wang, Bao, 1991].

V. nuoljae (Skuja) Vishnyakov (Fig. 6)

Localities and specimens: 4 — V-982. A single fertile specimen was found. Filament 95 μm in diam., oogonium 187.5 μm length and 135 μm in diam., antheridium 32.5 μm in diam. The fruiting branches of this species are characterized by pendent oogonia and black mature oospores.

V. nuoljae was previously known from the Holarctic under the names *V. terrestris* var. *nuoljae* Skuja, "*V. terrestris* var. *major*", and "*V. frigida* var. *major*" [Vishnyakov et al., 2020]. The nearest known localities are in Baikal Siberia, the Irkutsk Region [Vishnyakov, 2019], and NE China, the Inner Mongolia and Heilongjiang [Rieth, 1965; Wang, Bao, 1991].

V. racemosa (Vauch.) DC. (Figs 7, 8)

Localities and specimens: 5 — V-976, LE A0004239. Filaments 92.5–115 μm in diam., oogonia (3)4–7 per fruiting branch, 112.5–91.25 μm length, 60–77.5 μm in diam.; antheridia are 23.75–30 μm in diam.

V. racemosa is a semi-cosmopolitan species. The nearest known localities belong to Baikal Siberia [Vishnyakov, 2019] and NE China [Wang, Bao, 1991].

With 6 new localities, *V. alaskana* is the most common species in the studied material, followed by *V. canalicularis* (3), *V. nuoljae* (1), and *V. racemosa* (1). However, the actual occurrence of species is unlikely to be reflected by this result, as the Mongolian flora is still poorly studied. In the Lake Baikal region, *V. alaskana* is considered a rare species, with a higher prevalence in the East Sayan Mountains than in the plain; *V. canalicularis* and *V. racemosa* are among the most common species, second only to *V. bursata* [Vishnyakov, 2019, 2021]. Nevertheless, the fact that *V. alaskana* is common in the Lake Khövsgöl area is indeed notable and may reflect its wider distribution in cold mountainous regions.

Mongolia, with 5 currently known *Vaucheria* species, stretches between two relatively well studied regions, Baikal Siberia and NE China, where 21 species have been recorded, including 13 common ones (Table 1). Most species recorded in that regions can also be found in Mongolia. Furthermore, special taxonomic and nomenclature studies may well lead to the description of several novel species, given the presence of some intraspecific taxa whose morphologies differ from those known for the species, such as *V. bursata* var. *major* (B.H. Smith) Wang et Bao or "*V. racemosa* f. *rostrata*" [Rieth, 1980; Wang, Bao, 1991]. All of this makes the entire Asia-Pacific region promising for future *Vaucheria* studies.

Table 1. *Vaucheria* species in Baikal Siberia, NE China, and Mongolia

Species	Baikal Siberia	NE China	Mongolia
V. alaskana Blum	+	+	+
V. birostris Simons	+	+	
V. bursata (O. Müller) C. Agardh	+	+	+
V. canalicularis (L.) T.A. Chr.	+	+	+
V. cruciata (Vauch.) DC.	+	+	
V. fontinalis (L.) T.A. Chr.	+		
V. frigida (Roth) C. Agardh	+	+	
V. geminata (Vauch.) DC.		+	
V. leyana Wang et Bao		+	
V. lii Rieth		+	
V. megalaversa Vishnyakov	+		
V. nuoljae (Skuja) Vishnyakov	+	+	+
V. prona T.A. Chr.	+	+	
V. pseudaversa Vishnyakov	+	+	
V. racemosa (Vauch.) DC.	+	+	+
V. schleicheri De Wild.	+	+	
V. taylorii Blum	+	+	
V. terrestris (Vauch.) DC.		+	
V. uncinata Kütz.	+	+	
V. undulata C.-C. Jao		+	
V. verticillata Menegh.		+	
Total:	15	19	5

Main references: Baikal Siberia [Vishnyakov, 2019, 2021], NE China, only non-marine species are included [Rieth, 1963; Wang, Bao, 1991; Wang, 2007], Mongolia [Bukhchuluun, Baigal-Amar, 2018; this report].

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НОВЫЕ НАХОДКИ *VAUCHERIA* (XANTHOPHYCEAE) В МОНГОЛИИ

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В ходе экспедиций 2015 и 2022 гг. в центральной и северо-западной части Монголии были обнаружены 4 вида рода *Vaucheria*. *Vaucheria alaskana*, *V. nuoljae* и *V. racemosa* являются новыми для страны. Приведено краткое описание морфологии видов с иллюстрациями.

Ключевые слова: желтозеленые водоросли, Архангай аймак, Ховсгол аймак, Завхан аймак.